

A.25 Conservancy Fairy Shrimp (*Branchinecta conservatio*)

A.25.1 Legal Status

The Conservancy fairy shrimp (*Branchinecta conservatio*) was listed as endangered throughout its range under the Federal Endangered Species Act on September 19, 1994 (59 FR 48136). In September 2007, U.S. Fish and Wildlife Services (USFWS) published a 5-year review recommending that the species remain listed as endangered. Revised critical habitat was designated on February 10, 2006 (71 FR 7118), although none of the critical habitat units are within the BDCP Planning Area. This species is covered by the December 15, 2005, Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon.

The Conservancy fairy shrimp has no state regulatory status.

A.25.2 Species Distribution and Status

Range and Status

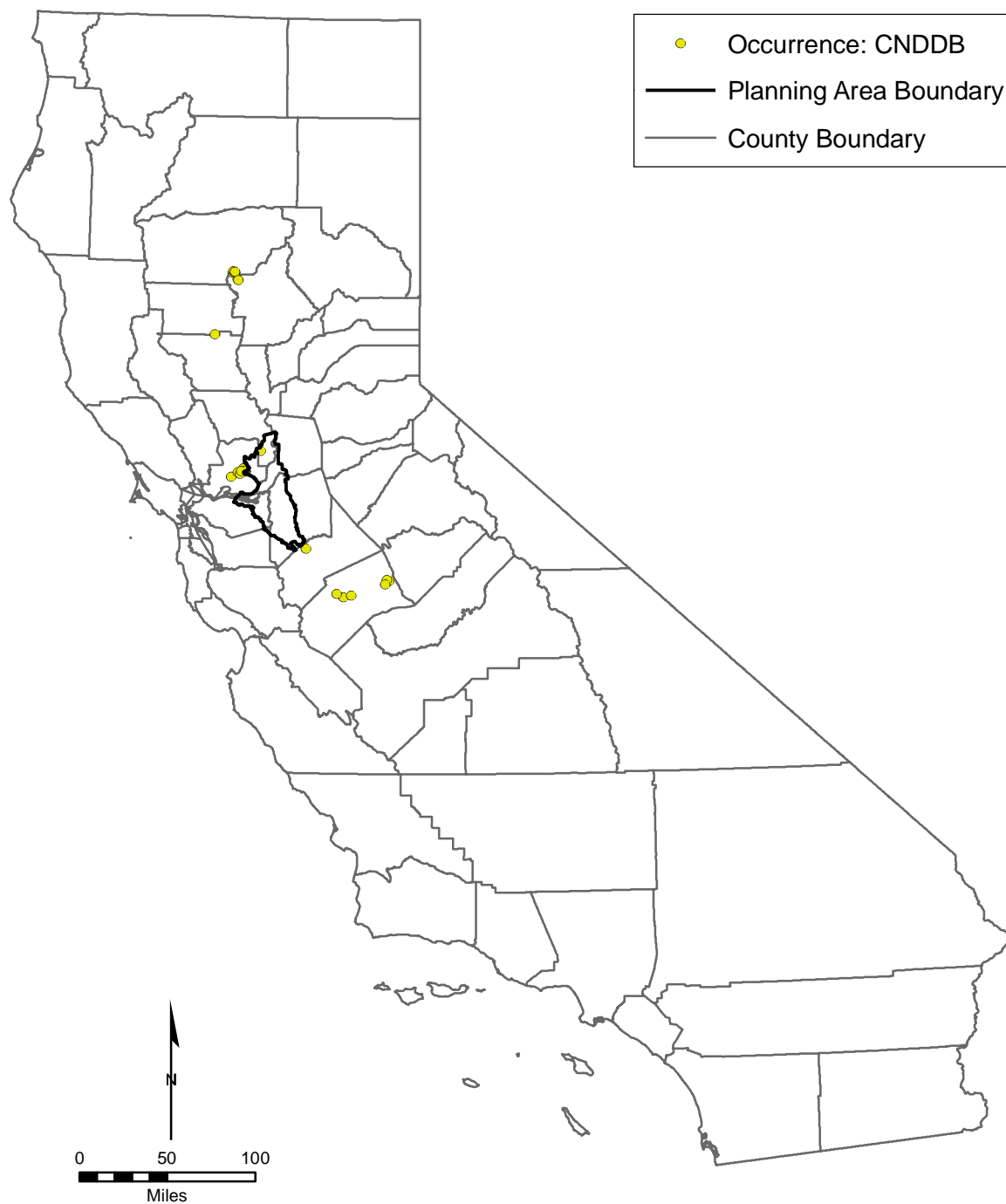
The historical distribution of the Conservancy fairy shrimp is not known, but the distribution of vernal pool habitats in the areas where the species is now known to occur was once more continuous and larger in area than today (USFWS 2005). The species is currently found in disjunct and fragmented habitats across the Central Valley of California from Tehama County to Merced County and at two southern California locations on the Los Padres National Forest in Ventura County (Figure A.25.1) (USFWS 2005, 2007, CNDDDB 2008).

Distribution and Status in the Planning Area

The Conservancy fairy shrimp is known to occur at three locations within the BDCP Planning Area (Figure A.25.2) (USFWS 2007). In general, within the BDCP Planning Area turbid-water playas and vernal pools that may support the species occur on alkaline soils from the DFG Tule Ranch Reserve southwest to the Montezuma Wetlands Mitigation Projects and from the Byron Airport to Discovery Bay. No critical habitat is present in the BDCP Planning Area.

A.25.3 Habitat Requirements and Special Conditions

Typical turbid-water habitats for Conservancy fairy shrimp in California are large, playa-type vernal pools or long inundation smaller vernal pools (Eng et al. 1990, USFWS 2007). The pools generally last until June, but the Conservancy fairy shrimp adult life stage has typically been completed before then (Eng and Eriksen 1990). They have been collected from early November to early April (Eng and Eriksen 1990). As with other vernal pool crustaceans, Conservancy fairy shrimp are sporadic in their distribution, often inhabiting only one or a few vernal pools in otherwise more widespread pool complexes. Pools within a complex typically are separated by distances on the order of 5 or more feet and may form dense, interconnected mosaics of small pools or a sparser scattering of larger pools (USFWS 2005). Conservancy fairy shrimp have been found in vernal pools ranging in size from 323 square feet to 88 acres at elevations ranging from 16 to 5,577 feet (USFWS 2005, 2007).



Source: California Department of Fish and Game, CNDDDB, 2008.

Figure A.25.1. Conservancy Shrimp Statewide Recorded Occurrences

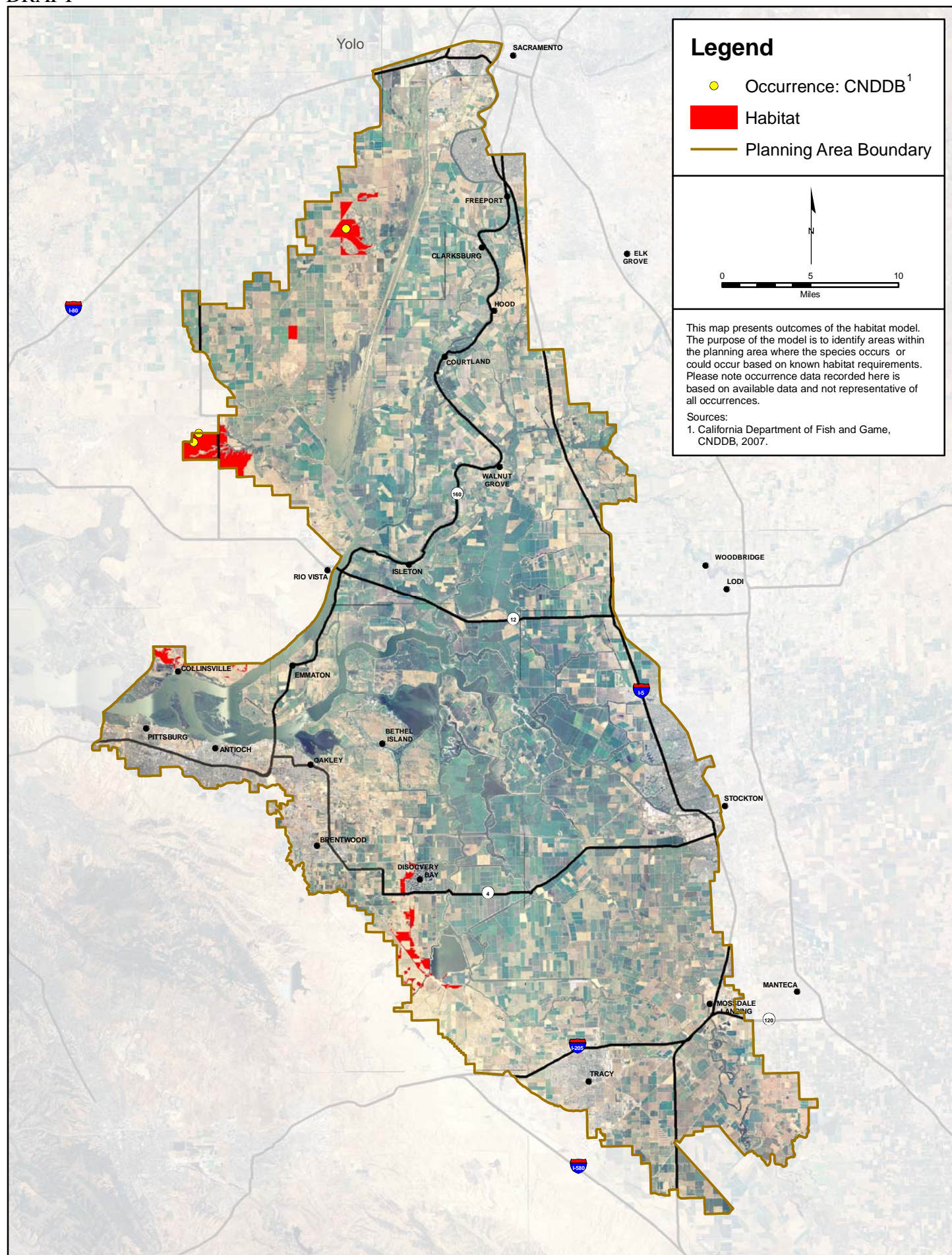


Figure A.25.2. Conservancy Shrimp Habitat Model and Recorded Occurrences

The Conservancy fairy shrimp occupies the same vernal pool habitats as many of the other vernal pool species, including several other rare and endangered vernal pool crustaceans. This species has been found in association with the vernal pool fairy shrimp (*Brachinecta lynchi*, federally listed as threatened), vernal pool tadpole shrimp (*Lepidurus packardii*, federally listed as endangered), and California fairy shrimp (*Linderiella occidentalis*, a species of concern). Although these species may all be found in one general location, they have rarely been collected from the same pool at the same time. In general, Conservancy fairy shrimp have very large populations within a given pool, and it is usually the most abundant fairy shrimp when more than one species is present (USFWS 2005, 2007).

The Conservancy fairy shrimp is a component of a larger invertebrate community structure (Rogers 1998). This invertebrate community includes mostly planktonic Crustacea dependent on temporary wetlands, including copepods, cladocerans, and ostracodes, as well as flatworms and a suite of insect species, including vernal pool halipid beetle (*Apterliplus parvulus*), scimitar backswimmers (*Buenoa scimitra*), Ricksecker's hydrochara (*Hydrochara rickseckeri*), and many others (Rogers 1998). These habitats are usually low in opportunistic species like mosquitoes and chironomid midges in the genus *Chironomus* (Rogers 1998).

A.25.4 Life History

Feeding. Conservancy fairy shrimp is an omnivorous filter-feeder. In general, all fairy shrimp species indiscriminately filter particles that include bacteria, unicellular algae, and micrometazoa (Eriksen and Belk 1999). The precise size of items these fairy shrimp are capable of filtering is currently unknown. However, fairy shrimp species will attempt to consume whatever material they can fit into their feeding groove and do not discriminate based upon taste, as do other crustacean groups (Eriksen and Belk 1999).

Ecology. Conservancy fairy shrimp are adapted to the environmental conditions of their ephemeral habitats. One adaptation is the ability of the vernal pool fairy shrimp eggs, or cysts, to remain dormant in the soil when their vernal pool habitats are dry. The cysts survive the hot, dry summers and cold, wet winters that follow until the vernal pools and swales fill with rainwater and conditions are right for hatching. When the pools refill in the same or subsequent seasons some, but not all, of the eggs may hatch. The egg bank in the soil may comprise eggs from several years of breeding (USFWS 2005, 2007).

Conservancy fairy shrimp has a relatively short life span which allows it to hatch, mature to adulthood, and reproduce during the period when playas and vernal pools contain water. When reared in plastic pools with their bottoms lined with soil excavated from vernal pools and without supplemental food this species completed its lifecycle in an average time of 46 days (Helm 1998). This life span is longer than other fairy shrimp but is still significantly shorter than the ponding duration of the vernal pools it inhabits which typically dry up in June (USFWS 2005, 2007).

A.25.5 Threats and Stressors

Threats to vernal pool habitat and species in general, including Conservancy fairy shrimp, were identified in the Recovery Plan (USFWS 2005). In addition, the Recovery Plan identified several threats specific to the Conservancy fairy shrimp.

Habitat loss and Fragmentation. Habitat loss and fragmentation were identified as the largest threats to the survival and recovery of vernal pool species. Habitat loss generally is a result of

1 urbanization, agricultural conversion, and mining and can also occur as a result of habitat
2 alteration and degradation due to changes to natural hydrology, invasive species, incompatible
3 grazing regimes (including insufficient grazing for prolonged periods), infrastructure projects
4 (such as roads and utility projects), recreational activities (such as off-highway vehicles and
5 hiking), erosion, climatic and environmental change, and contamination. Habitat fragmentation is
6 also related to habitat loss when individual vernal pools become disconnected and isolated as a
7 result of activities such as road development and other infrastructure projects. Widespread
8 urbanization and the construction of infrastructure are major contributors to the loss of vernal
9 pool habitats and their associated species. In addition, gravel and clay mining operations that are
10 needed to support urban developments, including roads and other infrastructure, have resulted in
11 the destruction of vernal pools (USFWS 2005, 2007).

12 **Agricultural Conversion and Incompatible Livestock Grazing Practices.** Conversion of land
13 use, such as from grasslands or pastures to more intensive agricultural uses (e.g., croplands) or
14 from one crop type to another, has contributed and continues to contribute to the decline of
15 vernal pools in general.

16 **Competition from Invasive Species.** Vernal pool plant species have declined due to the
17 introduction of invasive non-native plant and animal species. Increasing dominance by
18 competitors may also contribute to changes in hydrology and livestock grazing practices (Marty
19 2004).

20 **Altered Hydrology.** Changes in hydrology that result in a change in the timing, frequency, and
21 duration of inundation in vernal pools can create conditions that render existing vernal pools
22 unsuitable for vernal pool species. The vernal pool complexes in areas proposed for
23 developments could be affected by alteration of hydrology, which could diminish habitat for
24 Conservancy fairy shrimp (USFWS 2005).

25 **Contamination.** Slight changes in water chemistry directly affect sensitive vernal pool species,
26 especially vernal pool crustaceans. Water contamination can occur from herbicides, fertilizers,
27 and other chemicals commonly used in urban and agricultural settings. Pesticide applications for
28 controlling West Nile virus, a disease transmitted by infected mosquitoes, may also affect fairy
29 shrimp species. Fertilizers may also contribute to the growth of invasive plants (USFWS 2005).

30 **Other threats.** Several other threats to vernal pools, and their associate species in general, were
31 identified in the Recovery Plan (USFWS 2005). Although not specifically identified as a threat
32 to Conservancy fairy shrimp, these threats contribute to the decline of vernal pool habitats, which
33 would affect all species that are dependant on functional vernal pool habitats for survival.
34 Human use and recreational activities, such as off-road vehicle use, hiking, and bicycling,
35 threaten vernal pool ecosystems. When access is through vernal pool complexes, hydrological
36 functions may be impaired by displaced soil, causing erosion or interrupting swale connectivity.
37 Also, off-road enthusiasts, such as bicyclists, may create dirt jump ramps, which could result in
38 the burial of seeds and cysts of plants and animals or soil compaction. Recreational users also
39 may introduce, or facilitate spread of, invasive plants or dispose waste and debris into vernal
40 pool habitat and alter the ecology (USFWS 2005).

41 Habitat alteration may also occur due to large-scale climate and environmental changes, such as
42 global warming, which lead to changes in the precipitation pattern and atmospheric conditions.
43 Most of the populations of Conservancy fairy shrimp are isolated from other populations and are
44 distributed in discontinuous vernal pool systems; small, isolated populations are vulnerable,
45 which could result in extirpation from a particular area (USFWS 2005).

A.25.6 Relevant Conservation Efforts

The Conservancy fairy shrimp was listed as endangered and critical habitat was designated as noted above. The locations of the species within the BDCP Planning Area, however, are not included in any of the designated critical habitat areas. Throughout the range of the species, vernal pool habitats supporting populations of Conservancy fairy shrimp have been protected through a variety of other means, including preserves, refuges, and protections on private lands. Within the Solano-Colusa Vernal Pool Region, the Conservancy fairy shrimp is protected on the DFG Tule Ranch Reserve, the proposed Burke Ranch mitigation bank, in the Jepson Prairie Preserve system, and in the Montezuma Wetlands Mitigation site (Witham 2003, 2006, USFWS 2007).

The Conservancy fairy shrimp is covered under the approved Natomas Basin, San Joaquin, and East Contra Costa County Habitat Conservation Plans. Further, the species is proposed for coverage under the Solano County and Yolo County Habitat Conservation Plans.

A.25.7 Species Habitat Suitability Model

Habitat. Conservancy fairy shrimp habitat was identified as Natural Seasonal Wetlands and Grasslands on Antioch (AoA), Capay (Ca, Cc), Clear Lake (Ck), Diablo (DaC), Hillgate (HcA), Marcuse (Mb, Mc, Sb), Marvin (Mf), Pescadero (Pc, Pk), Rincon (Rg), Scribner (245), and Solano (Sh, Sk) soils (Figure A.25.2). Vegetation types designated as species habitat in this model correspond to the mapped vegetation associations in the BDCP GIS vegetation data layer (Hickson and Keeler-Wolf 2007). Aerial imagery (USDA 2005) and LiDAR elevation data (DWR 2007) were used to determine how intensively parcels included in the model had been farmed as the vegetation data included significant areas of fallow agricultural land that had been misclassified by DFG as various classes of natural vegetation. Sites without natural vernal pool and swale vegetation signatures and microtopography were deleted from the area of predicted habitat. Additionally, areas with known occurrences and habitat signatures were digitized and included as habitat.

Assumptions. Historical and current records of this species in the BDCP Planning Area indicate that its current distribution is limited to turbid vernal pools and playas on alkaline soil areas with intact vernal pool and swale microtopography along the western border of the BDCP Planning Area (Witham 2003, 2006, CNDDDB 2008). Artificial impoundments such as stock ponds or roadside ditches, that are known to provide habitat for this species, were not included in the model.

A.25.8 Recovery Goals

The recovery goal of the Conservancy fairy shrimp is to delist the species and ensure its long-term conservation (USFWS 2005). Interim goals are to: (1) stabilize and protect populations, (2) conduct research to refine reclassification and recovery criteria, and (3) downlist endangered species to threatened. Vernal pool habitats used by the species as well as historical and potential habitats need to be protected, and habitat management plans for these habitats need to be developed and implemented. Recovery criteria have been established in the Recovery Plan (USFWS 2005). The criteria to downlist the species are: protect 100 percent of the present occurrences and protect 95 percent of its suitable habitat in the Vina Plains, Caswell, Grassland Ecological Area, Ventura County, Jepson Prairie, Sacramento NWR, Collinsville, and Madera Core Areas. The criteria to delist the species are: protect 100 percent of newly discovered/reintroduced populations and regions and soil types from which surveys indicate the

species has been extirpated reintroduce the species into vernal pool regions and soil types from which surveys indicate that it has been extirpated (USFWS 2005).

Literature Cited

CNDDDB (California Natural Diversity Data Base RareFind). 2008. California Department of Fish and Game, Sacramento, CA. Ver. 3.1.0 with data generated on June 29, 2008.

DWR (California Department of Water Resources). 2007. Sacramento-San Joaquin Delta LiDAR surveys.

Eng, L., D. Belk, C. Eriksen. 1990. Californian Anostraca: Distribution, Habitat, and Status. *Journal of Crustacean Biology*. 10:247-277.

Eriksen, C., D. Belk. 1999. Fairy shrimps of California's pools, puddles, and playas. Mad River Press, Eureka, CA.

Helm, B. 1998. Biogeography of eight large branchiopods endemic to California. In: Witham, C.W., E.T. Bauder, D. Belk, W.R. Ferrin Jr., R. Orduff (eds.). *Ecology, conservation, and management of vernal pool ecosystems – proceedings from a 1996 conference*. California Native Plant Society, Sacramento, CA. pp. 124-139.

Hickson, D., T. Keeler-Wolf. 2007. Vegetation and land-use classification and map of the Sacramento-San Joaquin River Delta. Report to the Bay Delta Region of the California Dept. of Fish and Game. Sacramento, CA.

Marty, J. 2004. Effects of cattle grazing on diversity in ephemeral wetlands. *Conservation Biology*. 19:1626-1632.

Rogers, D.C. 1998. Aquatic macroinvertebrate occurrences and population trends in constructed and natural vernal pools in Folsom, California. In: Witham, C.W., E.T. Bauder, D. Belk, W.R. Ferrin Jr., and R. Orduff (eds.). *Ecology, conservation, and management of vernal pool ecosystems – proceedings from a 1996 conference*. California Native Plant Society, Sacramento, CA. pp. 224-235.

USDA (United States Department of Agriculture). 2005. National Agricultural Imaging Program.

USFWS (U.S. Fish and Wildlife Service). 2005. Recovery plan for Vernal Pool Ecosystems of California and Southern Oregon. Available at:
http://www.fws.gov/sacramento/es/recovery_plans/vp_recovery_plan_links.htm.

USFWS (U.S. Fish and Wildlife Service). 2007. Conservancy Fairy Shrimp, *Brachinecta conservatio* 5-year Review. Available at:
http://www.fws.gov/sacramento/es/5_year_reviews.htm.

Witham, C.W. 2003. Tule Ranch vernal pools botanical resources survey report. Yolo Basin Foundation, Davis, CA.

1 Witham, C.W. 2006. Greater Jepson Prairie ecosystem regional management plan. Fairfield:
2 Solano Land Trust.

3 **Federal Register Notices Cited**

4 59 FR 48136. 1994. Final Rule: Endangered and Threatened Wildlife and Plants: Determination
5 of endangered status for the conservancy fairy shrimp, longhorn fairy shrimp, and the
6 vernal pool tadpole shrimp; and threatened status for the vernal pool fairy shrimp. Federal
7 Register 59: 48136.

8 71 FR 7118. 2006. Final Rule: Endangered and Threatened Wildlife and Plants: Designation of
9 critical habitat for four vernal pool crustaceans and eleven vernal pool plants. Federal
10 Register 71: 7118.